



# The Evolution of Database Technology

**Duration: 2 hours**

# Detailed Syllabus



## 1.1. The Evolution of Database Technology (2hrs.)

### 1.1.1. Data

Information

Database

Database management system

Database system

Data processing and data management

Increasing use of data as a corporate resource

### 1.1.2. File oriented systems:

Meeting the need for random access processing

#### **Limitations of Traditional File Systems:**

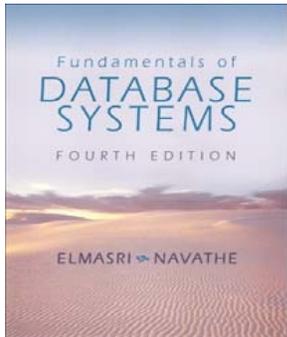
Data redundancy

Inadequate data manipulation capabilities

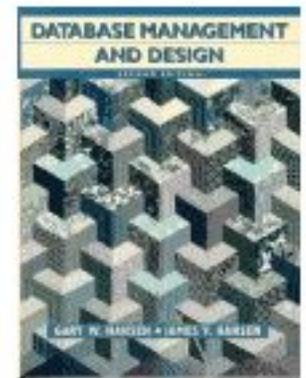
Program-data dependency

Data independence

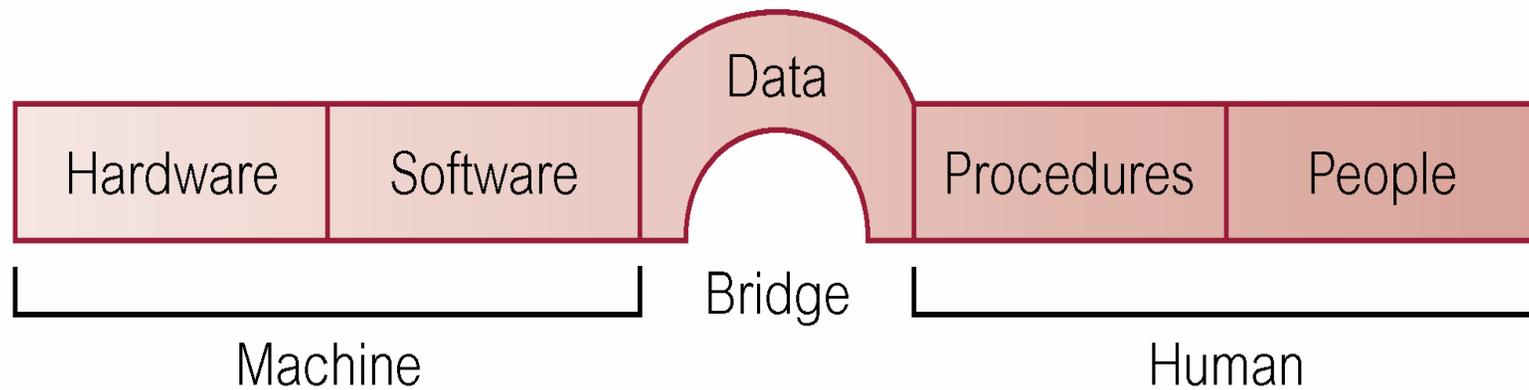
# Main References



- Database Management and Design by GW Hansen and JV Hansen.
- Fundamentals of Database Systems by Ramez Elmasri, Shamkant B. Navathe.



# Components of Database System Environment



# Components of Database System Environment

- **Hardware**

Set of physical devices on which a database resides.  
Can range from a PC to a network of computers.

- **Software**

- database management system (DBMS)
- operating system
- application programs
- User Interface

- **Data**

- Used by the organization and a description of this data called the schema.

# Components of Database System Environment



- **Data**

- A representation of facts, concepts or instructions in a formalised manner suitable for communication, interpretation or processing by human beings or by automatic means.

- Raw data which is unprocessed

- Text, colours, symbols, shapes, graphics, images, temperatures, sound, video or other facts and figures are data suitable for processing.

# Components of Database System Environment

- E.g. Person or Employee or Customer
- *name, address, phone, date of birth, designation, department, salary,*
- *employee no, photograph*

# Components of Database System Environment

- **Procedures**  
**Instructions and rules that should be applied to the design and use of the database.**
- **People**  
**Two different types of people (end-users and practitioners) are concerned with the database.**  
**End-Users**
  - are the ‘clients’ of the database, who need information from the database to carry out their duties.

e.g. Executives, managers, staff, clerical personnel

# Components of Database System

## Environment - People

### Practitioners

- people responsible for the database system and its associated application software.

e.g. Data and Database administrators, Database designers, Application developers.

# Information

- Information
- Knowledge derived from data.
- Processed or organised or summarised data.

Eg:-

- Process Date of Birth -> Age
- Process Salary (all) -> Highest paid employee
- Process all -> No of employees
- Process all -> Employees working for

# Why use a Database?

- Many people collect things
  - How about you?
- If you collect any thing, you probably are familiar with some of the problems of managing a collection
  - e.g. stamps, photos, paper cuttings
- One way to keep track of a collection is to create a database

# Why Database Technology?

The need to manipulate large collection of data for frequent used data queries and reports.

E.g. Collection of information on library books

Queries:

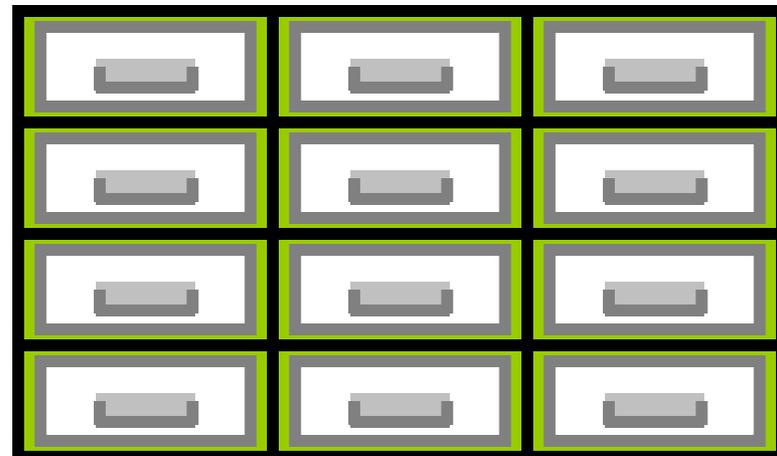
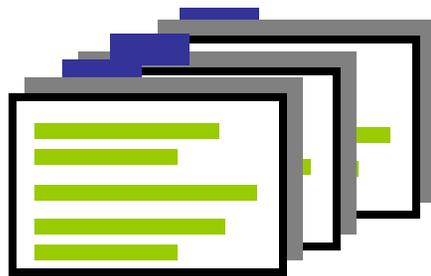
- List of books written by a particular author
- List of books about a particular subject
- Borrowing a book
- Reserving a book for borrowing

# Examples of Database Applications

- **Purchases from the supermarket**
- **Purchases using your credit card**
- **Booking a holiday at the travel agents**
- **Using the Internet**
- **Studying at university**

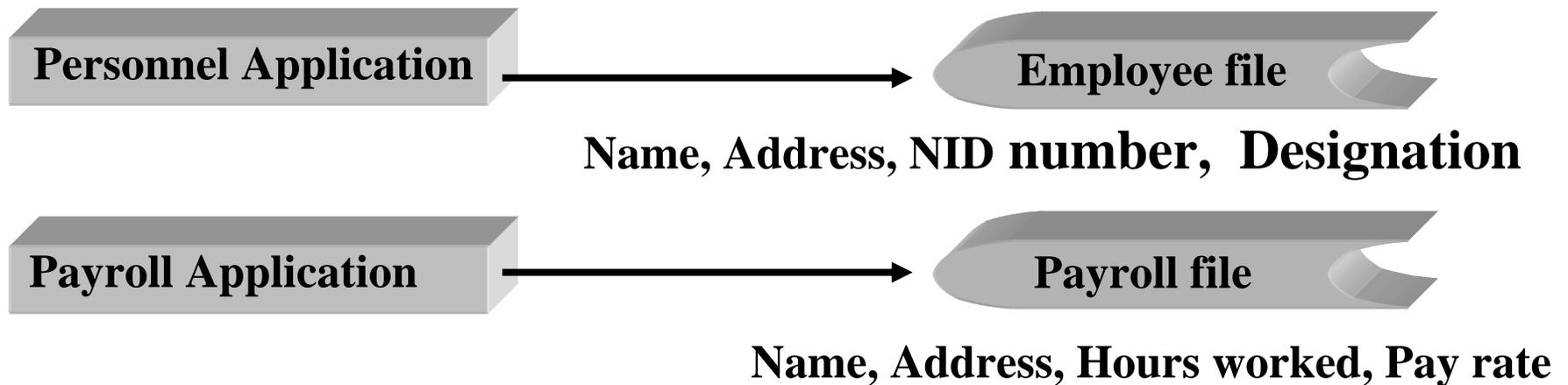
# Manual Systems – Information on library books

- Before and during most of last century, libraries used card catalogues stored in drawers of special cabinets
  - cards with typed book information
  - e.g. the title index has one card for every book in the library

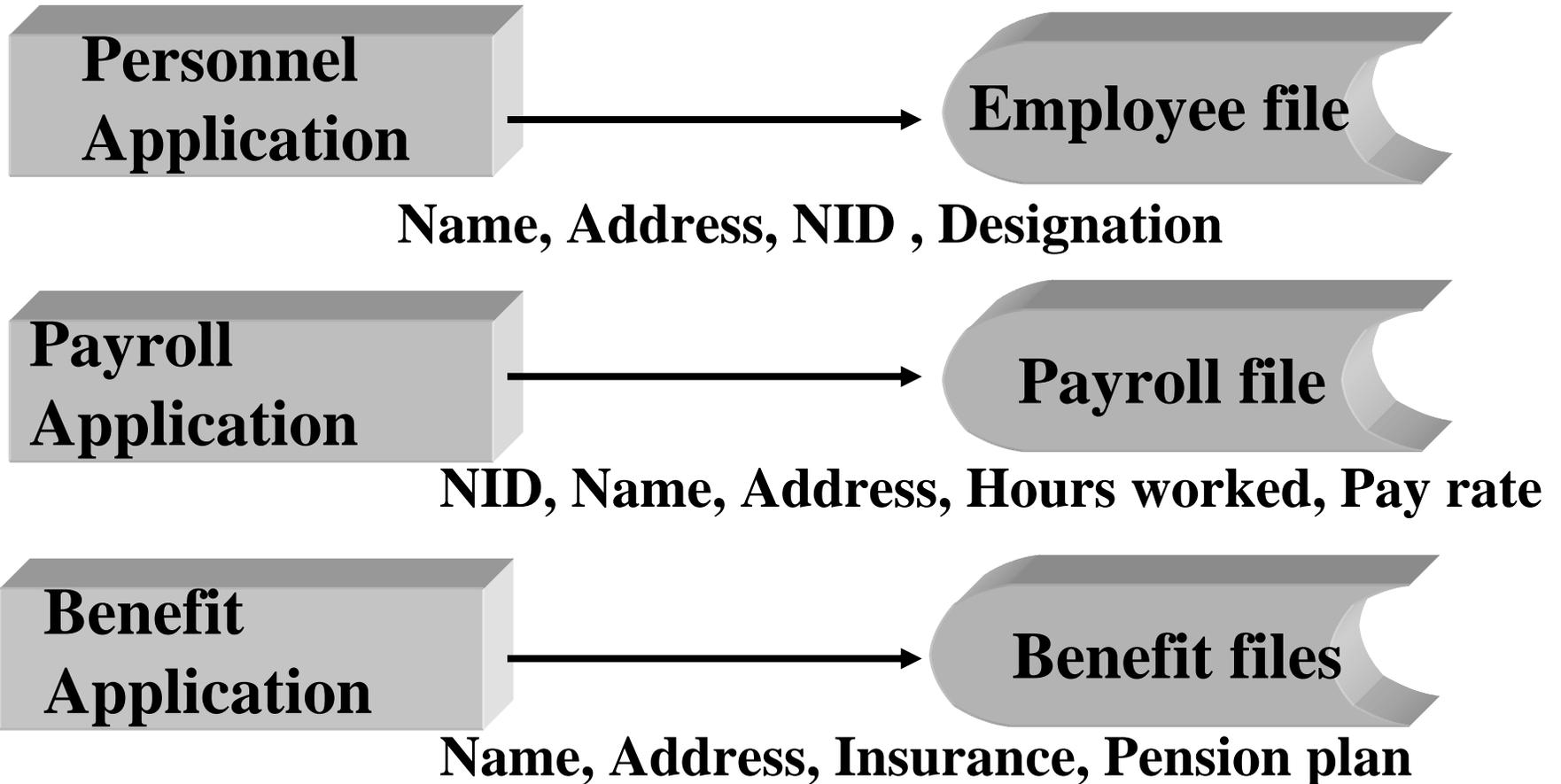


# File-Based Systems

- **Collection of application programs that perform services for the end users (e.g. reports).**
- **Each program defines and manages its own data.**



# Data Redundancy



# Limitations of File-Based Approach



- **Separation and isolation of data**
  - Each program maintains its own set of data.
  - Users of one program may be unaware of potentially useful data held by other programs.
- **Duplication of data**
  - Same data is held by different programs.
  - Wasted space and potentially different values and/or different formats for the same item.

# Limitations of File-Based Approach



- **Data dependence**
  - File structure is defined in the program code.
- **Incompatible file formats**
  - Programs are written in different languages, and so cannot easily access each other's files.
- **Fixed Queries/Proliferation of application programs**
  - Programs are written to satisfy particular functions.
  - Any new requirement needs a new program.

# Database Approach

- **Arose because:**
  - Definition of data was embedded in application programs, rather than being stored separately and independently.
  - No control over access and manipulation of data beyond that imposed by application programs.
- **Result:**
  - the database and Database Management System (DBMS).

# Database

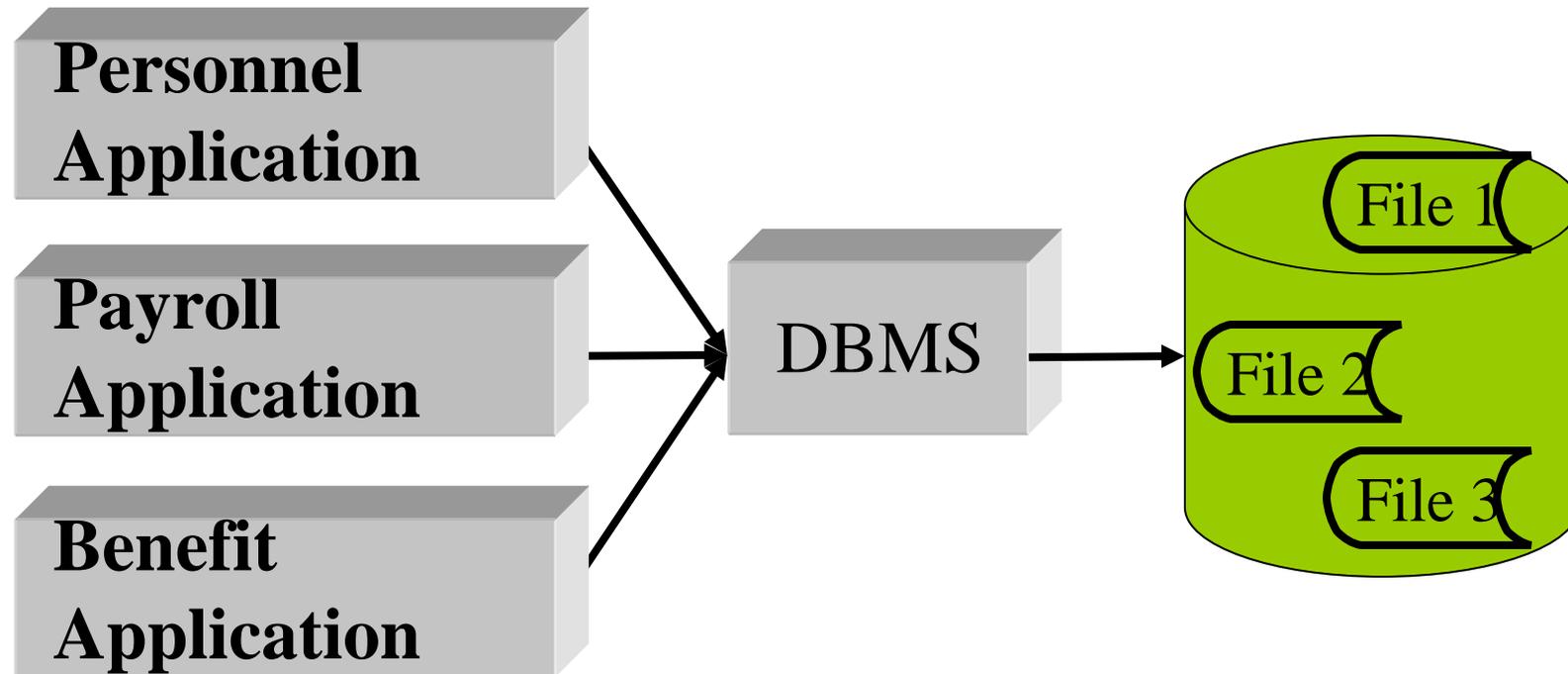
- **Shared collection of logically related data (and a description of this data), designed to meet the information needs of an organization.**
- System catalog or data dictionary provides description of data (metadata) to enable program–data independence.
- Logically related data comprises entities, attributes, and relationships of an organization’s information.

# Database Management System (DBMS)



- A software system that enables users to define, create, and maintain the database and that provides *controlled access* to this database.

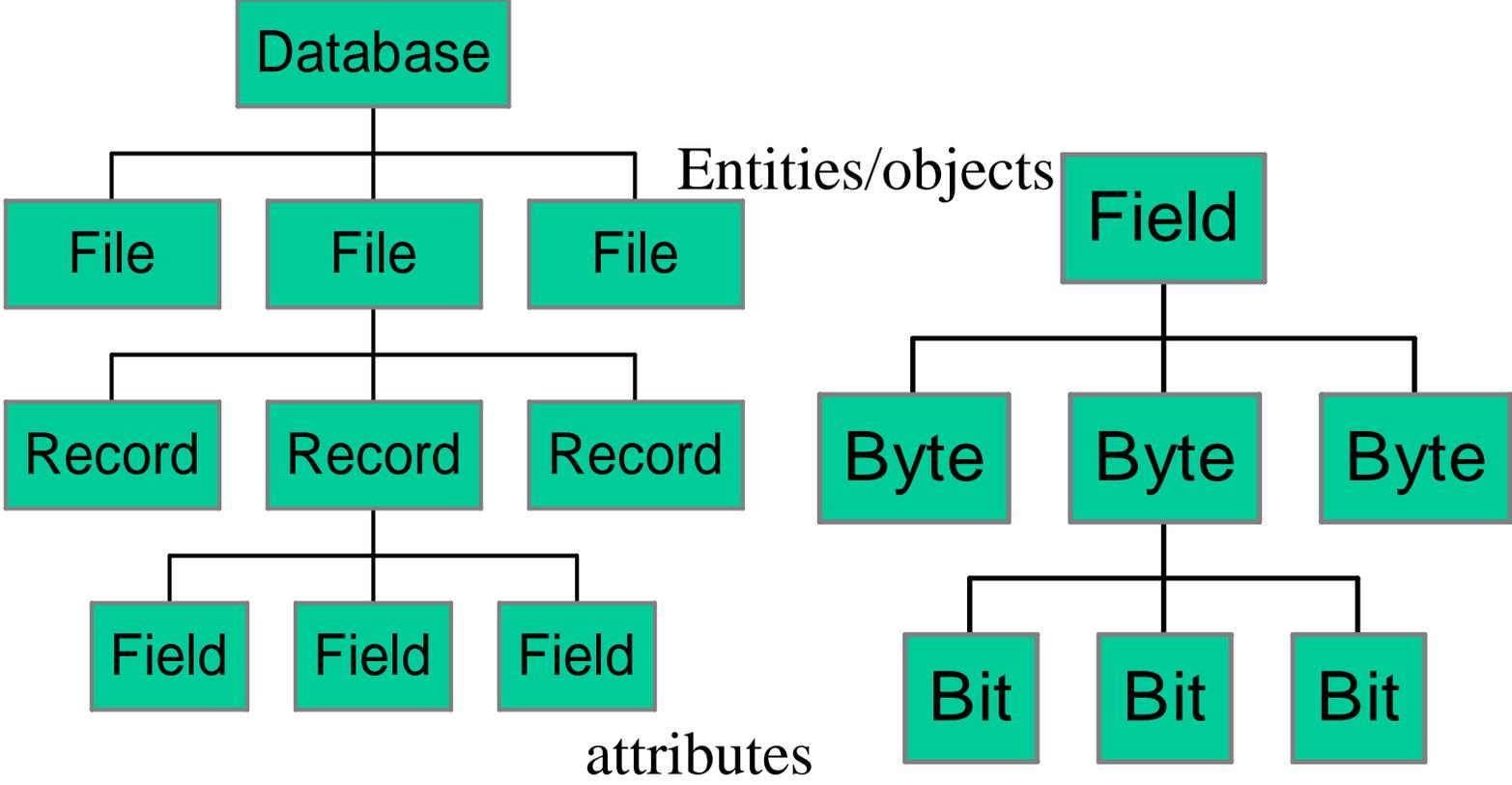
# Database Approach



e.g. Integrated human resources database

- **Employees:** *Name, Address, NID number, Designation*
- **Payroll:** *Hours worked, Pay rate*
- **Benefit:** *Insurance, Pension plan*

# Data Hierarchy



# Data Hierarchy

**Employee (Empno, Name, Designation, Salary, Depart)**

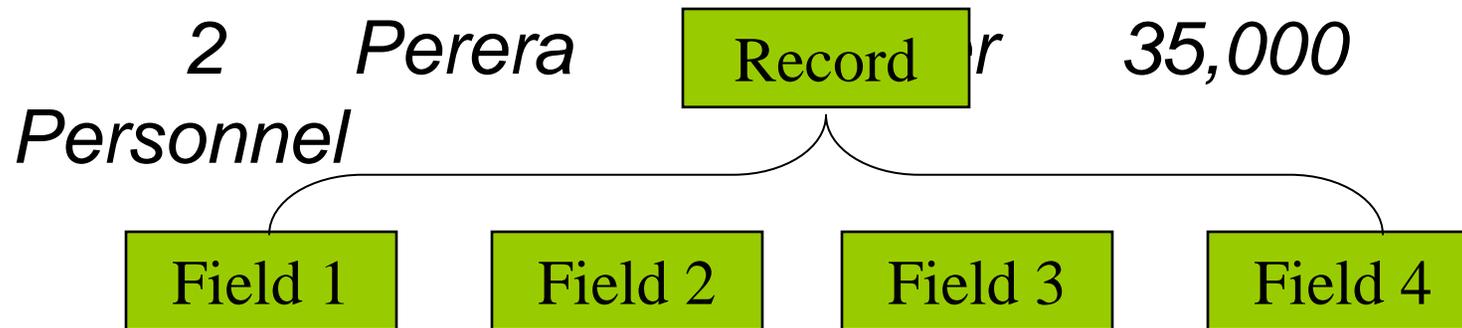
1	<i>De Silva</i>	<i>Manager</i>	<i>50000</i>	<i>Personnel</i>
2	<i>Perera</i>	<i>Secretary</i>	<i>15000</i>	<i>Personnel</i>
3	<i>Dias</i>	<i>Salesman</i>	<i>25000</i>	<i>Sales</i>

**Department (Depart, Manager, Dept Addr, Dept Phone)**

<i>Personnel</i>	<i>De Silva</i>	<i>Colombo</i>	<i>589123</i>
<i>Sales</i>	<i>Alwis</i>	<i>Kandy</i>	<i>987275</i>
....	....	....	....

# Data Hierarchy

(Empno, name, designation,  
salary, department)



Byte

- A single character (letter, number, symbol) is represented using a group of bits, E.g. 10101010 letter J in ASCII

Bit

- The smallest unit of data, E.g. 0 or 1